

**REPORT SUMMARY**  
**LICKING RIVER BASIN, CYNTHIANA, KENTUCKY, FLOOD DAMAGE REDUCTION STUDY**

**STUDY INFORMATION**

**STUDY AUTHORITY.** This study was initiated pursuant to provision of funds in the Energy and Water Development Appropriations Act, 1998 (P.L.105-62-Oct.13, 1997). The study was performed under the authority of a resolution by the Committee on Environment and Public Works of the United States Senate. The resolution was adopted on January 21, 1987, and reads as follows:

*“RESOLVED BY THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the Rivers and Harbors Act, approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers submitted in House Committee on Flood Control Document No. 1, 75th Congress, 1st session, and other reports, with a view of determining for flood control and other allied purposes in the Licking River basin, Kentucky.”*

Conference Report 105-271, 105th Congress, First Session, on Appropriations for Energy and Water Development for Fiscal Year 1998, page 45, allocated funds for General Investigation of the Licking River Watershed which includes Cynthiana, Paris, and Millersburg, Kentucky.

**STUDY SPONSOR.** The Feasibility Cost Sharing Agreement (FCSA) for this study was signed by the City of Cynthiana. However, there are other local contributors to the cost of the Feasibility Study, namely, Harrison County, Bourbon County, the City of Paris and the town of Millersburg. All these local contributors are signatories to an Inter-local Feasibility Funding Agreement. Additionally, the Commonwealth of Kentucky provided funds to defray fifty percent of the local cost share for the Feasibility Study.

**STUDY PURPOSE AND SCOPE.** This report is an interim response to the Study Authority. The purpose of the Cynthiana project is to address the flood problems occurring in the upper portion of the South Fork of the Licking River watershed affecting the Kentucky communities of Cynthiana, Paris, and Millersburg. The study developed and evaluated environmentally sustainable, and socially, economically, and technically acceptable means of solving these problems. The study has considered all reasonable alternative plans for flood damage reduction.

**PROJECT LOCATION/CONGRESSIONAL DISTRICT.** The South Fork basin lies in northeastern Kentucky in Harrison, Bourbon, Nicholas, Clark, and Montgomery Counties. The South Fork is formed at the confluence of its main tributaries, Hinkston and Stoner Creeks, approximately 16 miles upstream of Cynthiana near the county lines of Bourbon and Harrison Counties. Hinkston Creek has a drainage area of 260 square miles and Stoner Creek has a drainage area of 284 square miles. From its confluence with Stoner Creek, Hinkston Creek extends 71 miles upstream to its headwaters in Montgomery County. From its confluence with Hinkston Creek, Stoner Creek extends 73 miles upstream to its headwaters in Clark County. Both Stoner and Hinkston Creeks have their own upstream tributaries. The South Fork flows into the Licking River mainstem at Falmouth, Kentucky and has a drainage area of about 927 square miles at its confluence with the Licking River. The Licking River mainstem flows into the Ohio River at river mile 470.4 across from Cincinnati, Ohio. At Cynthiana the drainage area of

the South Fork is 621 square miles. The study area consists of Harrison, Bourbon, and Nicholas Counties, Kentucky, and includes both the urban core of the South Fork basin plus the areas where project components would be located (see Plate 1 – Study Area). The urban core of the South Fork basin consists of three communities, all of which sustain flood damage; Cynthiana in Harrison County and Paris and Millersburg in Bourbon County. Within this urban core, Cynthiana is the major damage center. Although project components would be located within portions of Bourbon and Nicholas Counties, Cynthiana, the major beneficiary of flood damage reduction, is located in Harrison County. The damage areas within the South Fork basin are physically separate from each other by significant distances.

The Congressional interests in the State of Kentucky for this project include: Senator Mitch McConnell, Senator Jim Bunning, and Honorable Geoff Davis (KY-04).

## **PRIOR REPORTS AND EXISTING WATER PROJECTS.**

A Feasibility Study for Water Resource Development in the Licking River basin, completed in September 1971, investigated solutions to flooding problems in the basin. That report, authorized under Section 6 of Public Law 738, 74th Congress, Second Session, included investigation of a 128,000 acre-foot multi-purpose reservoir on Hinkston Creek, a tributary of the South Fork. Due to local and other public opposition and a marginal BCR (1.0), the so-called Hinkston Lake project was not implemented.

A study conducted under Section 205 of the Continuing Authority Program (CAP) was completed in 1981, and investigated channel modifications for flood control along Houston Creek upstream from the community of Paris. Paris is located some 15 highway miles south of Cynthiana along Stoner Creek which is a tributary of the South Fork. The study primarily considered alternatives for flood control. None of the considered plans were economically feasible and the study was terminated.

In September 1990, an Interim Reconnaissance Report on the Licking River basin, Kentucky, investigated a number of water impoundments on the mainstem of the Licking River, South Fork Licking River, North Fork Licking River, Stoner Creek, Hinkston Creek, and several smaller tributaries. These alternatives varied in design from multi-purpose reservoirs to dry bed detention basins, and the controlled drainage areas ranged from a few square miles to over a thousand. In addition, local protection projects were considered for communities experiencing the highest localized flood damage, namely, Cynthiana, Falmouth, and Butler. Designs, detailed cost estimates, and detailed benefits were prepared for each of the considered alternatives. The study, which included consideration of channel improvement measures to protect Cynthiana, did not identify any economically feasible alternatives.

In early 1998 a Preliminary Assessment (PA), authorized under Section 205 of the Continuing Authority Program (CAP) assessed levee protection along Hinkston Creek as a potential solution to flooding problems in the community of Millersburg, located some 28.6 miles above Cynthiana. No economically feasible project was identified.

In 2004 a flood warning and emergency evacuation plan (FWEPP) for the communities in the study area was completed under the Section 205 program. Key elements of the FWEPP include a system for early recognition and evaluation of flood potential, procedures for issuance and dissemination of flood warning, and arrangements for evacuation of people and property.

**FEDERAL INTEREST.** This study has identified a flood damage reduction project with positive net economic benefits and no significant environmental impacts. The proposed project would consist of two (2) dry bed detention basins with a combined total cost of \$17,460,000 (October 2005 price levels), which includes 90 acres of mitigation plantings to offset unavoidable project

impacts to existing riparian hardwood areas. Average annual flood damages in the study area would be reduced by 86%, with a project benefit-to-cost ratio of 3.1.

## **STUDY OBJECTIVES**

**PROBLEMS AND OPPORTUNITIES.** The principal problem evaluated by this study is flood damage reduction. In March 1997 the study area experienced significant flooding, equivalent to a 1% chance (100-year) event. Communities in the Licking River basin, including Cynthiana, Paris and Millersburg, were subject to Federal and State declarations of major disasters. Existing average annual damages, in FY 2006 dollars, are estimated to be \$3,639,000: with \$3,229,000, or 88.7%, occurring in Cynthiana; \$383,000, or 10.5%, occurring in Paris; and \$27,000, or 0.7% occurring in Millersburg. In the study area 415 structures are located in the 1% (100-year) floodplain, and 452 structures in the 0.2% (500-year) floodplain. Over 75% of these structures are residential in use. A recurrence of the March 1997 event would cause over \$34 million in flood related damages.

**PLANNING OBJECTIVES.** The general planning objectives of this investigation were to identify possible flood damage reduction plans that would: (a) Provide the optimum scope of relief from flooding in Cynthiana, Paris and Millersburg; (b) Contribute to the social well-being of citizens in the flood prone communities in the upper portion of the South Fork basin by reducing concern about flooding problems and consequences; (c) Reduce the costs for emergency and disaster relief and rehabilitation measures required as a result of flooding; (d) Minimize adverse aesthetic impacts of both flooding and measures utilized to reduce flooding; (e) Provide full consideration of the environment in planning, development and management of water and related land resources; (f) Enhance habitats for fish and wildlife by creating areas for shrubs and forbs and areas for native grasses; and (g) Maintain community cohesion in alleviating public concerns and maximizing public acceptability of the potential project.

**PLANNING CONSTRAINTS.** The following constraints were identified for this study: (a) The plan must be effective in meeting the Federal planning objectives of flood damage reduction and maintenance of community cohesion; (b) The plan must be economically feasible; (c) The plan must be publicly acceptable; (d) The plan must be environmentally acceptable and sustainable; (e) The plan must be institutionally implementable; (f) The plan must be within the financial capability of the local sponsor.

## **ALTERNATIVES**

**PLAN FORMULATION RATIONALE.** Based on data developed during the reconnaissance phase of this study, and in prior flood studies of the basin, a number of potential strategies and measures to reduce flood damages in the study area had been ruled out before the feasibility phase began. Construction of levees, floodwalls, and/or large regional dams and reservoirs had been shown to be grossly economically infeasible. All practical non-structural strategies and measures (flood warning and emergency evacuation plans, flood proofing of vital structures, and buyout of severely damaged structures) were in the implementation stage by the time of this feasibility study. The study team focused its efforts on detention basins located on tributary streams and modifications to the channel of the South Fork.

**MANAGEMENT MEASURES AND ALTERNATIVE PLANS.** Alternative structural measures that have been evaluated in this study include: stand alone dry bed detention basins along four different tributary streams with dams of varying heights; one plan for a detention basin with a permanent pool; and two plans for stand alone high-flow cut-through channel modifications. See Plate 2 for the locations of these measures and Table 1 below for a description.

**TABLE 1**  
**STAND ALONE PROJECT MEASURES**  
**CYNTHIANA, KY, FLOOD DAMAGE REDUCTION PROJECT**

Plan 1 – HI783 Hinkston Detention Basin w/spillway crest at elevation 783 msl
Plan 2 – HI777 Hinkston Detention Basin w/spillway crest at elevation 777 msl
Plan 3 – HI772 Hinkston Detention Basin w/spillway crest at elevation 772 msl
Plan 4 – HO846 Houston Detention Basin w/spillway crest at elevation 846 msl
Plan 4A – HO843 Houston Detention Basin w/spillway crest at elevation 843 msl
Plan 5 - ST826 Strodes Detention Basin w/spillway crest at elevation 826 msl
Plan 6 – ST823 Strodes Detention Basin w/spillway crest at elevation 823 msl
Plan 7 – ST820 Strodes Detention Basin w/spillway crest at elevation 820 msl
Plan 8 – TO785 Townsend Detention Basin w/spillway crest at elevation 785 msl
Plan 9 – TO800 Townsend Detention Basin and Pool w/spillway crest at elevation 800 msl
Plan 16 – RCUT Railroad Cut-Through site between river miles 46.0 and 48.3
Plan 17 – BCUT Battlefield Cut-Through site between river miles 43.5 and 46.6

The locations of detention basins and cut-throughs were selected so that damage reduction would be maximized and cost of construction, especially relocation cost, would be minimized. There do not appear to be any additional suitable sites along upstream tributaries for detention basin alternatives that might further reduce flood damage in a cost effective manner in the upper South Fork basin. Different height dams were evaluated for each of the detention basins sites. Both earth and concrete dams were considered for the detention basin sites. Ultimately, roller compacted concrete (RCC) was determined to be the most efficient design from both a cost and safety standpoints. In addition to the 12 plans consisting of only one of the stand alone measures, there were many possible combinations of these measures that could be formulated into alternative plans. Many of these combination plans had overlapping hydrologic impacts and were dropped from consideration due to this inefficiency. Eighteen other plans that combined two or more of these measures in an efficient manner were evaluated in some detail and are described in Table 2 below.

**TABLE 2**  
**EVALUATED PLANS CONTAINING COMBINED MEASURES**  
**CYNTHIANA, KY, FLOOD DAMAGE REDUCTION PROJECT**

Plan 10 - HI783 (Hinkston DB) + HO843 (Houston DB)
Plan 11 – HI783 (Hinkston DB) + HO846 (Houston DB)
Plan 12 – HI777 (Hinkston DB) + ST820 (Strodes DB)
Plan 13 – HI772 (HinkstonDB) + ST820 (Strodes (DB)
Plan 13A – HI772 (Hinkston DB) + ST823 (Strodes DB)
Plan 13B – HI772 (Hinkston DB) +ST826 (Strodes DB)
Plan 14 – HO846 (Houston DB) + ST 826 (Strodes DB)
Plan 15 – HI783 (Hinkston DB) + HO846 (Houston DB) + ST826 (Strodes DB)
Plan 18 – HI783 (Hinkston DB) + RCUT (Railroad Cut-through)
Plan 19 – HI783 (Hinkston DB) + HO 846 (Houston DB) + RCUT (Railroad Cut-Through)
Plan 20 - HI783 (Hinkston DB) + ST826 (Strodes DB) + RCUT (Railroad Cut-Through)
Plan 21 – HI772 (Hinkston DB) + ST820 (Strodes DB) + RCUT (Railroad Cut-Through)
Plan 22 – HI783 (Hinkston DB) + HO846 (Houston DB) + ST826 (Strodes DB) + RCUT
Plan 23 – HI783 (Hinkston DB) + BCUT (Battlefield Cut-Through)
Plan 24 – HI783 (Hinkston DB) + HO846 (Houston DB) + BCUT (Battlefield Cut-Through)
Plan 25 – HI783 (Hinkston DB) + ST826 (Strodes DB) + BCUT (Battlefield Cut-Through)
Plan 26 – HI772 (Hinkston DB) + ST820 (Strodes DB) + BCUT (Battlefield Cut-Through)
Plan 27 – HI783 (Hinkston DB) + HO846 (Houston DB) + ST826 (Strodes DB) + BCUT

**FINAL ARRAY OF ALTERNATIVES.** Table3 below lists the screening level costs and benefits for the 30 plans that were evaluated in some detail as part of the feasibility study.

**TABLE 3**  
**SCREENING LEVEL ECONOMIC SUMMARY OF CONSIDERED PLANS (\$000)**  
**FY 2001 PRICE LEVEL (\$1000)**  
**6.125% INTEREST RATE**

Alternative Plan	Shared Project Costs	Interest During Construction	Total Economic Cost*	Total Annual Cost**	Annual Benefits	B/C Ratio	Net Benefits	Residual Damages***
Plan 1	10,787	556.0	11,343.0	738.0	2,120.0	2.9	1,382.0	1,064.0
Plan 2	8,789	455.0	9,244.0	603.0	2,120.0	3.5	<u>1,517.0</u>	1,064.0
Plan 3	6,570.0	339.0	6,909.0	452.0	1,985.0	4.4	1,533.0	1,199.0
Plan 4	4,822.0	241.0	5,063.0	333.0	336.0	1.0	3.0	2,848.0
Plan 4-A	4,270.0	213.0	4,483.0	295.0	71.0	0.2	-223.0	3,113.0
Plan 5	6,419.0	329.0	6,748.0	442.0	1,838.0	4.2	1,396.0	1,346.0
Plan 6	5,723.0	295.0	6,018.0	394.0	1,831.0	4.6	1,437.0	1,353.0
Plan 7	5,035.0	260.0	5,295.0	348.0	1,783.0	5.1	1,435.0	1,401.0
Plan 8	3,471.0	184.0	3,655.0	242.0	0.0	0.0	-242.0	3,184.0
Plan 9	11,665.0	592.0	12,257.0	797.0	50.0	0.1	-747.0	3,134.0
Plan 10	16,445.0	852.0	17,297.0	1,125.5	2,446.0	2.2	1,320.5	738.0
Plan 11	17,206.0	885.0	18,091.0	1,176.5	2,744.0	2.3	1,567.5	440.0
Plan 12	13,824.0	715.0	14,539.0	947.5	2,692.0	2.8	1,744.5	492.0
Plan 13	11,604.0	600.0	12,264.0	794.0	2,651.0	3.3	1,857.0	533.0
Plan 13-A	12,293.0	613.0	12,906.0	841.5	2,728.0	3.2	1,886.5	456.0
Plan 13-B	12,989.0	647.0	13,636.0	888.5	2,745.0	3.1	1,856.5	439.0
Plan 14	12,077.0	625.0	12,702.0	828.5	2,360.0	2.8	1,531.5	824.0
Plan 15	22,864.0	1,181.0	24,045.0	1,560.5	2,946.0	1.9	1,385.5	238.0
Plan 16	11,820.0	750.0	14,570.0	944.5	1,587.0	1.7	642.5	1,597.0
Plan 17	5,016.0	272.0	5,288.0	344.5	582.0	1.7	237.5	2,602.0
Plan 18	24,607.0	1,306.0	25,913.0	1,681.5	2,633.0	1.6	950.5	552.0
Plan 19	10,266.0	1,897.0	32,163.0	2,088.0	3,887.0	1.4	691.0	297.0
Plan 20	31,026.0	1,942.0	32,968.0	2,140.0	2,977.0	1.4	799.0	207.0
Plan 21	25,424.0	1,350.0	26,774.0	1,737.5	2,918.0	1.7	1,189.0	266.0
Plan 22	36,384.0	2,758.0	39,442.0	2,558.0	3,083.0	1.2	525.0	101.0
Plan 23	15,803.0	828.0	16,631.0	1,084.0	2,284.0	2.1	1,200.0	900.0
Plan 24	21,461.0	1,419.0	22,880.0	1,488.0	2,552.2	1.7	1,064.0	632.0
Plan 25	22,222.0	1,464.0	23,686.0	1,540.0	2,877.0	1.9	1,337.0	307.0
Plan 26	16,620.0	872.0	17,492.0	1,137.5	2,746.0	2.4	1,608.5	438.0
Plan 27	27,880.0	2,280.0	30,160.0	1,958.0	3,016.0	1.5	1,058.0	168.0

\*Includes construction, LERRD, and PED, and Interest During Construction Costs.

\*\*Includes estimated annual Operation and Maintenance cost.

\*\*\*Existing annual damages are \$3,184,00

**COMPARISON OF ALTERNATIVES.** The initial screening looked at simple project construction costs in comparison to standard flood damage reduction benefits. Plan 13-A, consisting of detention basins at Hinkston and Strides Creeks, was the plan with the highest net benefits of \$1,886,500. Potential mitigation requirements were then also evaluated. The 12 plans involving a cut-through would have incurred substantial mitigation costs in that they impacted the sites of two Civil War battles and spill over activities. Other historic and prehistoric features including National Register eligible structures and prehistoric settlements are also within the vicinity of the cut-throughs. Local citizenry and State Historic Preservation Office opposition to such alternatives was made very clear at various meetings. It was expected that national opposition, especially from Civil War battlefield preservation groups and re-enactors, would have developed had these alternatives been pursued further. For the remaining 18 plans, mitigation costs related to fish and wildlife resources would have been uniform across the plan components and would not have influenced plan selection. Therefore, a detailed mitigation cost as presented in the MCACES cost estimate was prepared only for the Recommended Plan or NED Plan. Also for these plans potential savings for non-physical flood damages such as emergency response costs were assumed to be essentially uniform across the plans, and relatively small in value, and would not have influenced plan selection. Therefore, detailed calculations for these non-physical damages were performed only for the Recommended Plan.

**KEY ASSUMPTIONS.** Some assumptions had to be made in order to perform feasibility level analyses. Considerable hydrologic work was performed during this study, however assumptions were made regarding the routing of the Standard Project Flood and the Probable Maximum Flood events, as well as the stilling basin designs that will need to be re-examined during PED. During the Feasibility Study, the assumption was that an RCC dam could withstand significant flow over its top and that the depth of flow would only be needed for calculating the forces acting on the dam. Further, it was assumed that, with the preliminary dam design being keyed into rock, no problem would be expected if a significant flow depth occurs over the dam.

**RECOMMENDED PLAN.** Plan 13-A, is the plan with the highest net economic benefits and provides substantial relief from the flood problems threatening the urban core in the area. The proposed flood damage reduction features consist of two dry bed detention basins that would be created by constructing roller compacted concrete dams on the Hinkston Creek and Strodes Creek tributaries to the South Fork of the Licking River. The Hinkston Creek detention structure, located just upstream of the Town of Millersburg, would have a height of about 30 feet, a length of about 680 feet, and would create a pool with a volume of about 8,188 acre-feet given an occurrence of the 0.2 percent chance (500-year) flood. The detention facility would include a 200-foot-long spillway, a 16-foot-wide by 12-foot-high gravity outlet, and a 1,500-foot-long access road. The Strodes Creek detention structure, located about 16 miles upstream of the town of Paris, Kentucky, would have a height of about 25 feet, a length of about 700 feet, and would create a pool of about 3,923 acre-feet during the 0.2 percent chance flood. It would include a 150-foot-long spillway, a 12-foot-wide by 10-foot-high gravity outlet, and an 8,000-foot-long access road. Mitigation for unavoidable environmental impacts associated with the proposed project would consist of 90 acres of hardwood plantings on project lands to offset the impacts of the detention structures on the existing riparian hardwood corridors in the vicinity of the proposed project. Existing average annual flood damages would be reduced by 86% under this plan. Since there is no other plan that local interests desire to propose as an alternative, and the plan is technically sound and environmentally sustainable, it is the Recommended Plan.

**LOCAL SPONSORSHIP / FINANCIAL ASSISTANCE.** The recommended plan is a single purpose flood damage reduction project. Cynthiaiana will be the local sponsor and will receive financial assistance from the Commonwealth of Kentucky (the Commonwealth) and from Harrison County through third party agreements. The Commonwealth will provide assistance to

Cynthiana equal to 65% of the local cost share, with the remaining 35% provided by Cynthiana and Harrison County in a 50-50 split.

**CIVIL WORKS STRATEGIC PLAN.** The goals of the Strategic Plan were achieved as follows:

Provide sustainable development and integrated management of the Nation's water resources

- Project designed to maximize the protection of the local community while minimizing the impacts on the environment

Repair past environmental degradation and prevent future environmental losses

- The use of a roller compacted concrete weir-type dam minimizes the footprint on the environment. The use of a dry dam prevents the environmental alterations that would be caused by a permanent pool detention basin.

Ensure that operating projects perform to meet authorized purposes and evolving conditions

- Annual operation and maintenance will protect the initial investment by monitoring performance and compliance.

Reduce vulnerabilities and losses to the Nation and the Army from natural and manmade disasters, including terrorism

- The project is designed to reduce the flood damages caused by low-level floods. Due to the type of construction, higher level flood events will not be made worse by the presence of the project.

Be a world-class public engineering organization

- The report underwent extensive independent technical review, including reviewers from outside agencies and academic institutions. All issues were resolved.
- The recommended plan is environmentally sustainable, economically and technically sound.

**ENVIRONMENTAL OPERATING PRINCIPLES.** The Corps Environmental Operating Principles (EOP) are consistent with NEPA; the Department of the Army's Environmental Strategy with its four pillars of prevention, compliance, restoration and conservation; and other environmental statutes and Water Resources Development Acts (WRDAs) that govern USACE activities. The EOP have guided the plan formulation process and are integrated into all proposed program and project management processes. The Cynthiana plan processes established to achieve the EOP goals are as follows:

1. **Environmental sustainability...** All project measures were designed to minimize the impacts to the environment with minimum operations and maintenance (O&M) requirements. This increases the potential of achieving sustainability of the ecosystem.
2. **Interdependence of life and the physical environment.** All project components were designed to protect the local community, reducing the risk for economic losses, as well as protection of life, while causing as little harm to the environment as possible.
3. **Seek balance and synergy between human and natural systems.** Coordination with the sister agencies assures that all environmental considerations were addressed in the formulation process. The construction footprint of the project is small, does not require the relocation of any utilities or structures and will not change existing land uses.
4. **Continue to accept corporate responsibility and accountability...** Continuous coordination with USFWS on the Endangered Species Act concerns was conducted.



5. **Assess and mitigate cumulative impacts to environment.** Projects were designed to minimize impacts to the environment during design and construction. Ninety acres of hard woods will be planted to mitigate for the footprint of the project.
6. **Build and share knowledge.** The Project Delivery Team utilized a multi-partner effort to obtain information for study and arrive at a Recommended Plan.
7. **Respect the views of individuals and groups.** Effectively listened to and incorporated views of others through public meetings, bi-monthly team meetings.

**INDEPENDENT TECHNICAL REVIEW.** An Independent Technical Review (ITR) Team was established concurrent with the Production Team, and was routinely brought into for review and comment at key points of the study process. The team represented the entire spectrum of required technical disciplines and involved multiple Corps Districts and the Corps Flood Damage Reduction Center of Expertise. Documentation of the ITR effort was submitted along with the feasibility report. Major issues raised during ITR involved hydrologic & hydraulic, geotechnical & structural, real estate, and local sponsorship items.

## **EXPECTED PROJECT PERFORMANCE**

**PROJECT COSTS.** Total first costs for the recommended project are summarized in Table 4 below.

**TABLE 4  
PROJECT FIRST COSTS  
CYNTHIANA, KY, FLOOD DAMAGE REDUCTION PROJECT  
(October 2005 Price Levels)**

Construction Item	Cost
Lands & Damages	\$ 5,140,000
Fish & Wildlife Mitigation	310,000
Dams & Reservoirs	9,130,000
Engineering & Design	2,070,000
Construction Management	810,000
<b>Total Project Construction Costs</b>	<b>\$ 17,460,000</b>

The total project construction cost shown above includes contingency funds of \$2,950,000, a factor representing approximately 20% of the initially estimated implementation cost. The fully funded cost of this project taking into account the impact of inflation between the base year of 2005 and the completion of construction is \$20,600,000. This assumes authorization by Congress and a funding stream supporting a completion of project construction by September 2013.

**EQUIVALENT ANNUAL COSTS AND BENEFITS.** A summary of the annualized project costs and benefits are shown below in Table 5. Analyses were calculated for discount rates of 5.125 percent (3.1 benefit/cost ratio) and 7.0 percent (2.4 benefit/cost ratio) per Executive Order 12893.

**TABLE 5**  
**EQUIVALENT ANNUAL BENEFITS AND COSTS**  
**CYNTHIANA, KY, FLOOD DAMAGE REDUCTION PROJECT**  
**(October 2005 Price Level, 50-Year Period of Analysis, 5.125 Percent Discount Rate)**

<u>Investment Costs:</u>	
Total Project Construction Costs	\$ 17,460,000
Interest During Construction	<u>995,000</u>
Total Investment Cost	\$ 18,455,000
<u>Average Annual Costs:</u>	
Interest and Amortization of Initial Investment	\$ 1,070,000
OMRR&R	<u>26,000</u>
Total Average Annual Costs	\$ 1,096,000
Average Annual Benefits	\$ 3,133,000
Net Annual Benefits	\$ 2,037,000
Benefit-Cost Ratio	3.1 to 1
Benefit-Cost Ratio (computed at 7%) <sup>1</sup>	2.4 to 1

<sup>1</sup> Per Executive Order 12893

**NED, EQ, RED, AND OSE.** For this project the Regional Economic Development (RED) benefits are virtually identical to the National Economic Development (NED) benefits. Environmental Quality (EQ) impacts are mostly of a temporary nature related to activities during project construction. A limited amount of riparian corridors containing hardwood growths would be permanently affected by construction and operation of the proposed projects. In agreement with state and federal fish & wildlife resources agencies, this will be mitigated by some 90 acres of new hardwood plantings on project lands. There is the possibility of existence of small amounts of Native American cultural resources within the footprints of the projects, but these are not considered to be potentially significant at this time. A large rural historic district encompassing a large portion of the three-count study area was recently established. However, the footprint of the project is very small in relation to the size of the historic district, and is not expected to have any significant impacts. The proposed project will have beneficial Other Social Effects (OSE) in that it will reduce the risk of loss of life from flooding, improve conditions for lower income residents in the floodplain, and lower the risk of flooding to over 400 structures. No businesses or structures will be relocated as a result of this project. Table 7, at the end of this report, summarizes the comparison of the Recommended and No-Action Plans.

**COST SHARING.** Standard cost sharing rules for flood damage reduction projects will apply to this project. The local sponsor will be required to pay a minimum of 35 % of the implementation costs, which includes responsibility for providing all lands, easements, rights-of-way, relocations, and disposal areas (LERRDS). For this project, LERRDS are estimated at \$5,136,000, or 29.4% of the total project cost of \$17,460,000. Non-Federal interests will be required to provide sufficient additional cash to bring their total contribution up to \$6,110,000, or 35% of the project cost.

**PROJECT IMPLEMENTATION.** Cynthiana will continue as the local sponsor executing agreements with the Corps. Harrison County and the Commonwealth of Kentucky will contribute substantial cost share funds by means of entering into a third party agreement with Cynthiana. This would be similar to the agreements that were executed among the contributing parties for the

Feasibility Study. Currently, Cynthiana does not expect any financial assistance from Paris, Millersburg, and Bourbon County. Once the Project Cooperation Agreement (PCA) and the third party agreements are executed, and upon completion of PED, real estate acquisition transactions would be carried out by the Corps on behalf of the local sponsor. Real estate transactions will be negotiated with property owners by attorneys/representatives of the District Real Estate Division and recommended to the local sponsor for settlement. Regularly scheduled meetings in which the local sponsor would consider the recommended settlements would be held. Transactions meeting the terms of willing buyers and sellers are expected to be the norm, with very few exceptions that could involve disputes requiring condemnation procedures. The local sponsor is aware that they have the option to contract with the District Real Estate Division to perform acquisition activity on their behalf, including pursuing condemnation procedures in the Federal District Court, and will exercise this option; Table 6 below provides an estimated breakdown of the local funding requirements.

**TABLE 6  
LOCAL COST SHARE BY PHASE AND SOURCE  
CYNTHIANA, KY, FLOOD DAMAGE REDUCTION PROJECT  
(October 2005 Price Levels)**

IMPLEMENTATION PHASE	CONTRIBUTING SOURCE	AMOUNT	TOTAL PHASE
PED PHASE	LOCAL FUNDING: CYNTHIANA / HARRISON \$ 181,500 (\$90,750 EACH) COMMONWEALTH OF KENTUCKY:	\$ 181,500  \$ 337,000	\$ 518,500*
REAL ESTATE ACQUISITION PHASE	LOCAL FUNDING: CYNTHIANA / HARRISON \$1,776,600 (\$888,150 EACH) COMMONWEALTH OF KENTUCKY:	\$1,776,600  \$3,299,400	\$5,076,000
CONSTRUCTION PHASE	LOCAL FUNDING: CYNTHIANA \$183,900 (\$91,950 EACH) COMMONWEALTH OF KENTUCKY:	\$ 183,900  \$ 341,600	\$ 525,500***
LOCAL COST SHARE FOR ALL PHASES	5% CASH REQUIRED: PED CASH PAYMENT \$ 518,500* BALANCE OF THE 5% CASH AFTER PED \$ 354,500** ADDITIONAL CASH: REAL ESTATE COSTS:	\$ 873,000  \$ 161,000 \$5,076,000	\$6,110,000

\* A part of the 5% cash requirement.

\*\*Due during the first year of construction, and consists of \$354,500 in cash which is the remainder of the 5% cash requirement after PED, plus additional cash of \$161,000.

\*\*\*By the end of the real estate acquisition, most of the local cost share, or \$5,594,500, would have been expended, with only \$525,500 remaining for the construction phase.

## **OPERATION, MAINTENANCE, REPAIR, REHABILITATION, AND REPLACEMENT (OMRR&R).**

Upon completion of the prospective flood damage reduction project, the local sponsor would be responsible for project operation and maintenance, including operation and maintenance of the impounding structures, the modified channel sections, the approach channels, the dry beds of the detention basins, and the mitigation areas. In general, the local sponsor would follow the applicable procedures outlined in 33 Code of Federal Regulations, Chapter 11, Section 208.10. Periodic inspections by the local sponsor of the modified channel sections or adjacent channel areas would be made to ensure that: (i) The channels are clear of debris, weeds, and wild growth. (ii) The channels are not being restricted by waste materials, or unauthorized encroachments. (iii) The channel capacities are not being reduced by the accumulation of sediment or formation of shoals. (iv) The banks are not being damaged by rain or wave wash and that no sloughing of banks is occurring. (v) Riprap sections, if any, are in good condition. (vi) Approach channels adjacent to the modified channel sections are sufficiently clear of obstructions and debris to permit proper functioning of the project. Inspections would be made prior to the beginning of the flood season and at intervals not to exceed 90 days. Where applicable, measures would be taken to promote the growth of grass on bank slopes and to provide for routine mowing of the grass and weeds, and removal of wild growth. Periodic inspections of the detentions basins would be made to ensure that: (i) The capacity of the detention basins has not been reduced by sediment or debris deposited during flood conditions. Removal of this material would be required periodically. The material would be disposed of at an outside landfill. (ii) Side slopes or adjacent areas inside and outside the basins are not being damaged by wave wash and that no sloughing of the slopes has occurred. (iii) Spillways and drainage outlets are clean. Inspections of the basins would be made prior to the beginning of the flood season and at intervals not to exceed 90 days. Adequate measures would be taken to ensure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage outlets. Periodic inspections would be made by the sponsor to ascertain that: (i) Inlet and outlet channels are open and clear of debris. (ii) Erosion is not occurring that would endanger the structural stability of the drainage outlets. (iii) Riprap, if any, is in good condition. No major repairs, rehabilitations, or replacements are expected on this project during the 50-year life cycle. Sedimentation within the detention basins would be minimal. The operation, maintenance, repair, rehabilitation, and replacement cost is estimated at \$26,000 annually. Maintenance work should normally be completed with manual labor, without heavy equipment. These procedures will be specified in greater detail in an Operation and Maintenance Manual, to be prepared by the District for use by the local sponsor. All work items specified in the Operation and Maintenance Manual would be subject to periodic inspection by the Operations Division of the Louisville District.

**KEY SOCIAL AND ENVIRONMENTAL FACTORS.** A major issue that influenced formulation was the existence of local cultural and historical resources in the study area. Several of the considered alternatives would have adversely affected a local Civil War battlefield sites. Avoidance of these sites played a significant role in eliminating these alternatives from further consideration. There is the possibility of existence of small amounts of Native American cultural resources within the footprints of the proposed project, but these are not considered to be potentially significant at this time. A large rural historic district encompassing a large portion of the three-county study area was recently established. However, the footprint of the proposed project is very small in relation to the size of the historic district, and is not expected to have any significant impacts. Adverse environmental impacts have been minimized by avoiding, wherever practical, significant resources in the study area, and through sound engineering practices. Unavoidable adverse impacts are mostly of a temporary nature related to activities during project construction. A limited amount of riparian corridors containing hardwood growths would be permanently affected by construction and operation of the proposed projects. In agreement with state and federal fish & wildlife resources agencies, this will be mitigated by some 90 acres of new hardwood plantings on project lands. The proposed project will have beneficial social effects in that it will reduce the risk of loss of life from flooding, improve conditions for lower income residents in the floodplain, and lower the risk of

flooding to over 400 structures. No businesses or structures will be relocated as a result of the proposed project.

**STAKEHOLDER PERSPECTIVES AND DIFFERENCES.** Substantial efforts were made to insure formulation of an environmentally sustainable and publicly acceptable project. Input was solicited from the appropriate state and Federal resource agencies, local agencies and the public at large. Widely advertised public meetings in Paris and Cynthiana, and an inter-agency public involvement meeting in Frankfort were held to gather input from interested persons, stakeholders and agencies and to provide answers to their questions. The meetings in Cynthiana and Paris were heavily attended. Major issues raised were: impacts to lands upstream of the proposed detention basins; impacts of project components on cultural/historical resources; and impacts of hydrologic regime changes on the existing riparian corridor. Relatively few comments were received in response to circulation of the draft feasibility report, and raised no new major issues.

Some landowners upstream of the dam sites were concerned that water would be retained behind these structures for excessively long periods and would radically change the land uses, particularly those currently in agriculture. In fact, even with a 1% chance (100-year) flood event, water would be retained for at most three days in the portion of the basin closest to the dam. For lesser events the duration time would decrease. This should not cause major shifts in existing land uses.

Some of the measures, especially the high flow cut-throughs, evaluated in the study would have had dramatic impacts on two historic civil war battlefield sites. Others could have impacts on pre-historic and/or Native American cultural resources. There is a very large rural historic district recently established in the study area that would encompass most of the project feature locations. However, the proposed project completely avoids the Civil War battlefields, and with its small construction footprint, will have little, if any, impacts on the other cultural/historical resources. Additional fieldwork and effort has been included in the PED schedule to verify the current findings.

After consultation with the appropriate state and Federal resource agencies, we have determined that the only compensable mitigation requirement on the project is for 90 acres of hardwood plantings to offset unavoidable impacts to existing riparian hardwood corridors in the vicinity of the proposed detention basins. Avoidance measures, incorporating environmental best practices, and sound engineering design were basic components of the formulation process. The cost of this compensable mitigation item is only \$310,000. A Finding of No Significant Impact was issued for this project.

**STATE AND AGENCY REVIEW COORDINATION.** The final report and proposed Chief of Engineers report were circulated to the State of Kentucky and Federal agencies for comment on 26 April 2006. We received a letter dated 23 May 2006 from Department of Interior with no comments. We received verbal concurrences from Department of Agriculture (20 June 2006); Federal Emergency Management Agency (28 June 2006) and Environmental Protection Agency (28 June 2006). Due to retirements and personnel changes within the State of Kentucky Office of the Governor, we were unable to gain a response from the State until 16 August 2006 when they replied via e-mail that they had no concerns regarding the project in its current phase. They did, however, provide a list of minor comments for the district to address during the Pre-Construction, Engineering and Design phase.